

# AQUEOUS EQUILIBRIUM CONSTANTS

**TABLE D.1 • Dissociation Constants for Acids at 25 °C**

Name	Formula	$K_{a1}$	$K_{a2}$	$K_{a3}$
Acetic acid	$\text{CH}_3\text{COOH}$ (or $\text{HC}_2\text{H}_3\text{O}_2$ )	$1.8 \times 10^{-5}$		
Arsenic acid	$\text{H}_3\text{AsO}_4$	$5.6 \times 10^{-3}$	$1.0 \times 10^{-7}$	$3.0 \times 10^{-12}$
Arsenous acid	$\text{H}_3\text{AsO}_3$	$5.1 \times 10^{-10}$		
Ascorbic acid	$\text{H}_2\text{C}_6\text{H}_6\text{O}_6$	$8.0 \times 10^{-5}$	$1.6 \times 10^{-12}$	
Benzoic acid	$\text{C}_6\text{H}_5\text{COOH}$ (or $\text{HC}_7\text{H}_5\text{O}_2$ )	$6.3 \times 10^{-5}$		
Boric acid	$\text{H}_3\text{BO}_3$	$5.8 \times 10^{-10}$		
Butanoic acid	$\text{C}_3\text{H}_7\text{COOH}$ (or $\text{HC}_4\text{H}_7\text{O}_2$ )	$1.5 \times 10^{-5}$		
Carbonic acid	$\text{H}_2\text{CO}_3$	$4.3 \times 10^{-7}$	$5.6 \times 10^{-11}$	
Chloroacetic acid	$\text{CH}_2\text{ClCOOH}$ (or $\text{HC}_2\text{H}_2\text{O}_2\text{Cl}$ )	$1.4 \times 10^{-3}$		
Chlorous acid	$\text{HClO}_2$	$1.1 \times 10^{-2}$		
Citric acid	$\text{HOCC(OH)(CH}_2\text{COOH)}_2$ (or $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$ )	$7.4 \times 10^{-4}$	$1.7 \times 10^{-5}$	$4.0 \times 10^{-7}$
Cyanic acid	$\text{HCNO}$	$3.5 \times 10^{-4}$		
Formic acid	$\text{HCOOH}$ (or $\text{HCHO}_2$ )	$1.8 \times 10^{-4}$		
Hydroazoic acid	$\text{HN}_3$	$1.9 \times 10^{-5}$		
Hydrocyanic acid	$\text{HCN}$	$4.9 \times 10^{-10}$		
Hydrofluoric acid	$\text{HF}$	$6.8 \times 10^{-4}$		
Hydrogen chromate ion	$\text{HCrO}_4^-$	$3.0 \times 10^{-7}$		
Hydrogen peroxide	$\text{H}_2\text{O}_2$	$2.4 \times 10^{-12}$		
Hydrogen selenate ion	$\text{HSeO}_4^-$	$2.2 \times 10^{-2}$		
Hydrogen sulfide	$\text{H}_2\text{S}$	$9.5 \times 10^{-8}$	$1 \times 10^{-19}$	
Hypobromous acid	$\text{HBrO}$	$2.5 \times 10^{-9}$		
Hypochlorous acid	$\text{HClO}$	$3.0 \times 10^{-8}$		
Hypoiodous acid	$\text{HIO}$	$2.3 \times 10^{-11}$		
Iodic acid	$\text{HIO}_3$	$1.7 \times 10^{-1}$		
Lactic acid	$\text{CH}_3\text{CH(OH)COOH}$ (or $\text{HC}_3\text{H}_5\text{O}_3$ )	$1.4 \times 10^{-4}$		
Malonic acid	$\text{CH}_2(\text{COOH})_2$ (or $\text{H}_2\text{C}_3\text{H}_2\text{O}_4$ )	$1.5 \times 10^{-3}$	$2.0 \times 10^{-6}$	
Nitrous acid	$\text{HNO}_2$	$4.5 \times 10^{-4}$		
Oxalic acid	$(\text{COOH})_2$ (or $\text{H}_2\text{C}_2\text{O}_4$ )	$5.9 \times 10^{-2}$	$6.4 \times 10^{-5}$	
Paraperiodic acid	$\text{H}_5\text{IO}_6$	$2.8 \times 10^{-2}$	$5.3 \times 10^{-9}$	
Phenol	$\text{C}_6\text{H}_5\text{OH}$ (or $\text{HC}_6\text{H}_5\text{O}$ )	$1.3 \times 10^{-10}$		
Phosphoric acid	$\text{H}_3\text{PO}_4$	$7.5 \times 10^{-3}$	$6.2 \times 10^{-8}$	$4.2 \times 10^{-13}$
Propionic acid	$\text{C}_2\text{H}_5\text{COOH}$ (or $\text{HC}_3\text{H}_5\text{O}_2$ )	$1.3 \times 10^{-5}$		
Pyrophosphoric acid	$\text{H}_4\text{P}_2\text{O}_7$	$3.0 \times 10^{-2}$	$4.4 \times 10^{-3}$	$2.1 \times 10^{-7}$
Selenous acid	$\text{H}_2\text{SeO}_3$	$2.3 \times 10^{-3}$	$5.3 \times 10^{-9}$	
Sulfuric acid	$\text{H}_2\text{SO}_4$	Strong acid	$1.2 \times 10^{-2}$	
Sulfurous acid	$\text{H}_2\text{SO}_3$	$1.7 \times 10^{-2}$	$6.4 \times 10^{-8}$	
Tartaric acid	$\text{HOOC(CHOH)}_2\text{COOH}$ (or $\text{H}_2\text{C}_4\text{H}_4\text{O}_6$ )	$1.0 \times 10^{-3}$		

**TABLE D.2 • Dissociation Constants for Bases at 25 °C**

Name	Formula	$K_b$
Ammonia	$\text{NH}_3$	$1.8 \times 10^{-5}$
Aniline	$\text{C}_6\text{H}_5\text{NH}_2$	$4.3 \times 10^{-10}$
Dimethylamine	$(\text{CH}_3)_2\text{NH}$	$5.4 \times 10^{-4}$
Ethylamine	$\text{C}_2\text{H}_5\text{NH}_2$	$6.4 \times 10^{-4}$
Hydrazine	$\text{H}_2\text{NNH}_2$	$1.3 \times 10^{-6}$
Hydroxylamine	$\text{HONH}_2$	$1.1 \times 10^{-8}$
Methylamine	$\text{CH}_3\text{NH}_2$	$4.4 \times 10^{-4}$
Pyridine	$\text{C}_5\text{H}_5\text{N}$	$1.7 \times 10^{-9}$
Trimethylamine	$(\text{CH}_3)_3\text{N}$	$6.4 \times 10^{-5}$

**TABLE D.3 • Solubility-Product Constants for Compounds at 25 °C**

Name	Formula	$K_{sp}$	Name	Formula	$K_{sp}$
Barium carbonate	$\text{BaCO}_3$	$5.0 \times 10^{-9}$	Lead(II) fluoride	$\text{PbF}_2$	$3.6 \times 10^{-8}$
Barium chromate	$\text{BaCrO}_4$	$2.1 \times 10^{-10}$	Lead(II) sulfate	$\text{PbSO}_4$	$6.3 \times 10^{-7}$
Barium fluoride	$\text{BaF}_2$	$1.7 \times 10^{-6}$	Lead(II) sulfide*	$\text{PbS}$	$3 \times 10^{-28}$
Barium oxalate	$\text{BaC}_2\text{O}_4$	$1.6 \times 10^{-6}$	Magnesium hydroxide	$\text{Mg}(\text{OH})_2$	$1.8 \times 10^{-11}$
Barium sulfate	$\text{BaSO}_4$	$1.1 \times 10^{-10}$	Magnesium carbonate	$\text{MgCO}_3$	$3.5 \times 10^{-8}$
Cadmium carbonate	$\text{CdCO}_3$	$1.8 \times 10^{-14}$	Magnesium oxalate	$\text{MgC}_2\text{O}_4$	$8.6 \times 10^{-5}$
Cadmium hydroxide	$\text{Cd}(\text{OH})_2$	$2.5 \times 10^{-14}$	Manganese(II) carbonate	$\text{MnCO}_3$	$5.0 \times 10^{-10}$
Cadmium sulfide*	$\text{CdS}$	$8 \times 10^{-28}$	Manganese(II) hydroxide	$\text{Mn}(\text{OH})_2$	$1.6 \times 10^{-13}$
Calcium carbonate (calcite)	$\text{CaCO}_3$	$4.5 \times 10^{-9}$	Manganese(II) sulfide*	$\text{MnS}$	$2 \times 10^{-53}$
Calcium chromate	$\text{CaCrO}_4$	$4.5 \times 10^{-9}$	Mercury(I) chloride	$\text{Hg}_2\text{Cl}_2$	$1.2 \times 10^{-18}$
Calcium fluoride	$\text{CaF}_2$	$3.9 \times 10^{-11}$	Mercury(I) iodide	$\text{Hg}_2\text{I}_2$	$1.1 \times 10^{-11}$
Calcium hydroxide	$\text{Ca}(\text{OH})_2$	$6.5 \times 10^{-6}$	Mercury(II) sulfide*	$\text{HgS}$	$2 \times 10^{-53}$
Calcium phosphate	$\text{Ca}_3(\text{PO}_4)_2$	$2.0 \times 10^{-29}$	Nickel(II) carbonate	$\text{NiCO}_3$	$1.3 \times 10^{-7}$
Calcium sulfate	$\text{CaSO}_4$	$2.4 \times 10^{-5}$	Nickel(II) hydroxide	$\text{Ni}(\text{OH})_2$	$6.0 \times 10^{-16}$
Chromium(III) hydroxide	$\text{Cr}(\text{OH})_3$	$1.6 \times 10^{-30}$	Nickel(II) sulfide*	$\text{NiS}$	$3 \times 10^{-20}$
Cobalt(II) carbonate	$\text{CoCO}_3$	$1.0 \times 10^{-10}$	Silver bromate	$\text{AgBrO}_3$	$5.5 \times 10^{-13}$
Cobalt(II) hydroxide	$\text{Co}(\text{OH})_2$	$1.3 \times 10^{-15}$	Silver bromide	$\text{AgBr}$	$5.0 \times 10^{-13}$
Cobalt(II) sulfide*	$\text{CoS}$	$5 \times 10^{-22}$	Silver carbonate	$\text{Ag}_2\text{CO}_3$	$8.1 \times 10^{-12}$
Copper(I) bromide	$\text{CuBr}$	$5.3 \times 10^{-9}$	Silver chloride	$\text{AgCl}$	$1.8 \times 10^{-10}$
Copper(II) carbonate	$\text{CuCO}_3$	$2.3 \times 10^{-10}$	Silver chromate	$\text{Ag}_2\text{CrO}_4$	$1.2 \times 10^{-12}$
Copper(II) hydroxide	$\text{Cu}(\text{OH})_2$	$4.8 \times 10^{-20}$	Silver iodide	$\text{AgI}$	$8.3 \times 10^{-17}$
Copper(II) sulfide*	$\text{CuS}$	$6 \times 10^{-37}$	Silver sulfate	$\text{Ag}_2\text{SO}_4$	$1.5 \times 10^{-5}$
Iron(II) carbonate	$\text{FeCO}_3$	$2.1 \times 10^{-11}$	Silver sulfide*	$\text{Ag}_2\text{S}$	$6 \times 10^{-51}$
Iron(II) hydroxide	$\text{Fe}(\text{OH})_2$	$7.9 \times 10^{-16}$	Strontium carbonate	$\text{SrCO}_3$	$9.3 \times 10^{-10}$
Lanthanum fluoride	$\text{LaF}_3$	$2 \times 10^{-19}$	Tin(II) sulfide*	$\text{SnS}$	$1 \times 10^{-26}$
Lanthanum iodate	$\text{La}(\text{IO}_3)_3$	$7.4 \times 10^{-14}$	Zinc carbonate	$\text{ZnCO}_3$	$1.0 \times 10^{-10}$
Lead(II) carbonate	$\text{PbCO}_3$	$7.4 \times 10^{-14}$	Zinc hydroxide	$\text{Zn}(\text{OH})_2$	$3.0 \times 10^{-16}$
Lead(II) chloride	$\text{PbCl}_2$	$1.7 \times 10^{-5}$	Zinc oxalate	$\text{ZnC}_2\text{O}_4$	$2.7 \times 10^{-8}$
Lead(II) chromate	$\text{PbCrO}_4$	$2.8 \times 10^{-13}$	Zinc sulfide*	$\text{ZnS}$	$2 \times 10^{-25}$

\*For a solubility equilibrium of the type  $\text{MS}(s) + \text{H}_2\text{O}(l) \rightleftharpoons \text{M}^{2+}(aq) + \text{HS}^-(aq) + \text{OH}^-(aq)$